What is Claimed:

1. An insulated chemical reactor comprising:

a reaction vessel having a wall with inner and outer surfaces;

an evacuated insulation shell spaced apart from and surrounding said reaction vessel;

at least one isothermal mixing baffle disposed within said reaction vessel;

a phase separator in fluid communication with said baffle so that only one saturated or sub-cooled liquid phase of a heat transfer working fluid enters said isothermal mixing baffle;

a temperature controlling helical channel coil fixed to said outer surface of said wall of said reaction vessel, said helical channel coil having at least two walls disposed normal to the outer surface of said wall of said vessel, thus defining an open helical channel coil fixed to said wall of said vessel, said helical channel coil having a winding pitch so that successive coils of said channel coil are spaced apart from each other, thus defining a closed path to receive a fluid to contact said wall of said reaction vessel, said wall of said reaction vessel being of a thickness less than that required for use under a given temperature and pressure regime, said channel coil serving to add structural strength to said wall of said reaction vessel, so that said reaction vessel with said channel coil fixed thereto can be operated under said temperature and pressure regime; said helical channel coil fixed to said outer surface to enhance conductive heat transfer and transfer of convective energy flow inside said helical channel coil through said wall of said vessel; and

means to combine vapor from said phase separator and vapor from said isothermal mixing baffle and introduce said vapor into said helical channel coil.

2. A reactor as claimed in claim 1, wherein said temperature controlling helical channel coil comprises a generally rectangular shaped channel fixed to said outer surface of said reaction vessel, said

channel coil and said wall of said reaction vessel defining a closed fluid flow passage.

3. A reactor as claimed in claim 2, wherein said helical channel coil comprises two flat, parallel walls, each in contact with said reaction vessel normal to the surface of said reaction vessel surface.

4. A reactor as claimed in claim 1, further including insulating material covering an outside surface of said helical channel coil.

5. A reactor as claimed in claim 1, wherein said heat transfer working fluid is selected from the group consisting of nitrogen, helium, brine, steam, chilled water, carbon dioxide, ammonia, CF4, methanol, ethanol, ethane, ethylene, methane, R134A and hot water.

6. An apparatus for isothermally cooling contents of a reaction vessel having a top and a bottom, by allowing a saturated or subcooled liquid to boil inside an isothermal mixing baffle immersed in said reactor contents, to produce gas inside said isothermal mixing baffle, comprising:

a vertically oriented, elongated generally cylindrical isothermal mixing baffle having a top and a bottom, said isothermal mixing baffle immersed in said contents in said reaction vessel;

means for introducing said liquid into the top of said isothermal mixing baffle to a predetermined level;

means for removing gas from said isothermal mixing baffle; and,

means for controlling the level of liquid in said isothermal mixing baffle.

7. An apparatus as claimed in claim 6, including a phase separator to control flow of liquid into or out of said isothermal mixing baffle.

8. An apparatus according to claim 6, wherein said isothermal mixing baffle is placed to prevent entrained carryover of liquid phase into a channel coil surrounding said reaction vessel.

9. An apparatus as claimed in claim 6, wherein said means for introducing said liquid comprises an inlet line extending through said top of said isothermal mixing baffle, and extending coaxially through a portion of said isothermal mixing baffle.

10 An apparatus as claimed in claim 6, wherein said means for removing said gas comprises an outlet line in fluid communication with the top of said isothermal mixing baffle.

11. An apparatus as claimed in claim 6, wherein two or more isothermal mixing baffles are immersed in said contents.

12. An apparatus as claimed in claim 6, wherein said isothermal mixing baffle is inserted into said reaction vessel through said top of said reaction vessel.

13. An apparatus as claimed in claim 6, wherein said isothermal mixing baffle is inserted into said reaction vessel through said bottom of said reaction vessel.

14. An apparatus for supplying saturated or superheated gas to a temperature controlling helical channel coil disposed helically around a reaction vessel, comprising:

an isothermal mixing baffle, immersed in contents contained in said reactor, said mixing baffle containing a saturated or subcooled liquid;

means for supplying vapor discharged from said isothermal mixing baffle to said helical channel coil;

means for monitoring flow of said vapor into said helical channel coil; and,

means for controlling flow of vapor into said helical channel coil.

15. An apparatus according to claim 14, including a phase separator for receiving a working fluid selected from the group consisting of nitrogen, helium, brine, steam, chilled water, carbon dioxide, ammonia, CF4, methanol, ethanol, ethane, ethylene, methane, R134A and hot water, said phase separator including means to separate and direct saturated vapor phases to said temperature controlling helical channel coil or a device for mixing said saturated vapor phase with gas discharged from said isothermal mixing baffles.

16. A method for controlling the temperature in a reaction vessel comprising the steps of:

disposing a helical channel temperature control coil around an outside surface of said reaction vessel;

introducing a heat transfer working fluid into a phase separator;

withdrawing a liquid portion of said working fluid from said phase separator and introducing said liquid portion into an isothermal mixing baffle disposed in contents contained in said reaction vessel;

withdrawing a vapor portion of said working fluid from said phase separator and mixing it with a vapor phase working fluid withdrawn from said isothermal mixing baffle to produce a mixed heat exchange fluid; and

introducing said mixed heat exchange fluid into said helical channel coil.

17. A method according to claim 16, including the step of:

selecting said heat transfer fluid from the group consisting of nitrogen, helium, brine, steam, chilled water, carbon dioxide, ammonia, CF4, methanol, ethanol, ethane, ethylene, methane R134A, and hot water.

18. A method according to claim 16, including the step of:

controlling flow rate of liquid flow into said isothermal mixing baffle to control heat transfer to said contents in said reaction vessel.

19. A method according to claim 16, including the step of:

controlling level of liquid heat transfer agent in said isothermal mixing baffle to control heat transfer of said contents in said reaction vessel.

20. A method according to claim 16, including the step of:

heating said contents in said reaction vessel by introducing a hot gas into said isothermal mixing baffle.